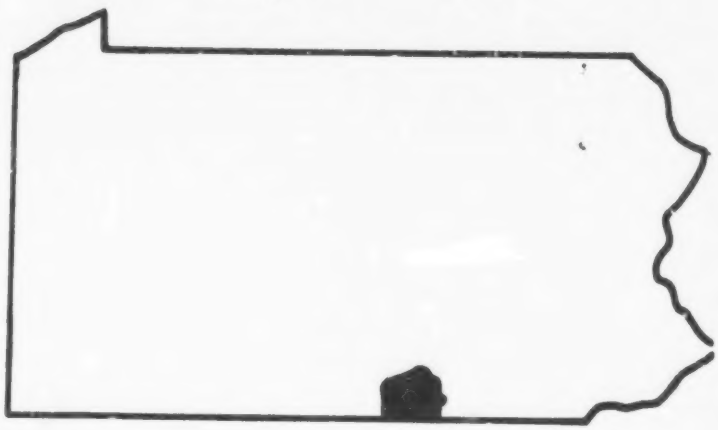
JUN 18 1988

FEM 1.209:422635

FLOOD INSURANCE STUDY

ORIGINAL



BOROUGH OF CARROLL VALLEY, PENNSYLVANIA
ADAMS COUNTY

SEPTEMBER 2, 1988

BEST COPY AVAILABLE

Federal Emergency Management Agency

COMMUNITY NUMBER - 422635

COMPLETED

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance study purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance study purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
	1.1 Purpose of Study	1
	1.2 Authority and Acknowledgments	1
	1.3 Coordination	1
2.0	AREA STUDIED	1
	2.1 Scope of Study	1
	2.2 Community Description	3
	2.3 Principal Flood Problems	3
	2.4 Flood Protection Measures	3
3.0	ENGINEERING METHODS	3
	3.1 Hydrologic Analyses	4
	3.2 Hydraulic Analyses	4
4.0	FLOODPLAIN MANAGEMENT APPLICATIONS	5
	4.1 Floodplain Boundaries	5
	4.2 Floodways	6
5.0	INSURANCE APPLICATIONS	6
6.0	FLOOD INSURANCE RATE MAP	9
7.0	OTHER STUDIES	9
8.0	LOCATION OF DATA	9
9.0	BIBLIOGRAPHY AND REFERENCES	9

111

TABLE OF CONTENTS - continued

Page

FIGURES

Figure 1 - Vicinity Map 2

Figure 2 - Floodway Schematic 7

TABLES

Table 1 - Summary of Discharges 4

EXHIBITS

Exhibit 1 - Flood Profiles
Toms Creek Panels 01P-08P
Friends Creek Panels 09P-10P

Exhibit 2 - Flood Insurance Rate Map and Street Index

Exhibit 3 - Elevation Reference Marks

FLOOD INSURANCE STUDY
BOROUGH OF CARROLL VALLEY, ADAMS COUNTY, PENNSYLVANIA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Borough of Carroll Valley, Adams County, Pennsylvania, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by the U. S. Geological Survey (USGS) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-85-E-1823, Project Order No. 8. This work was completed in January 1987.

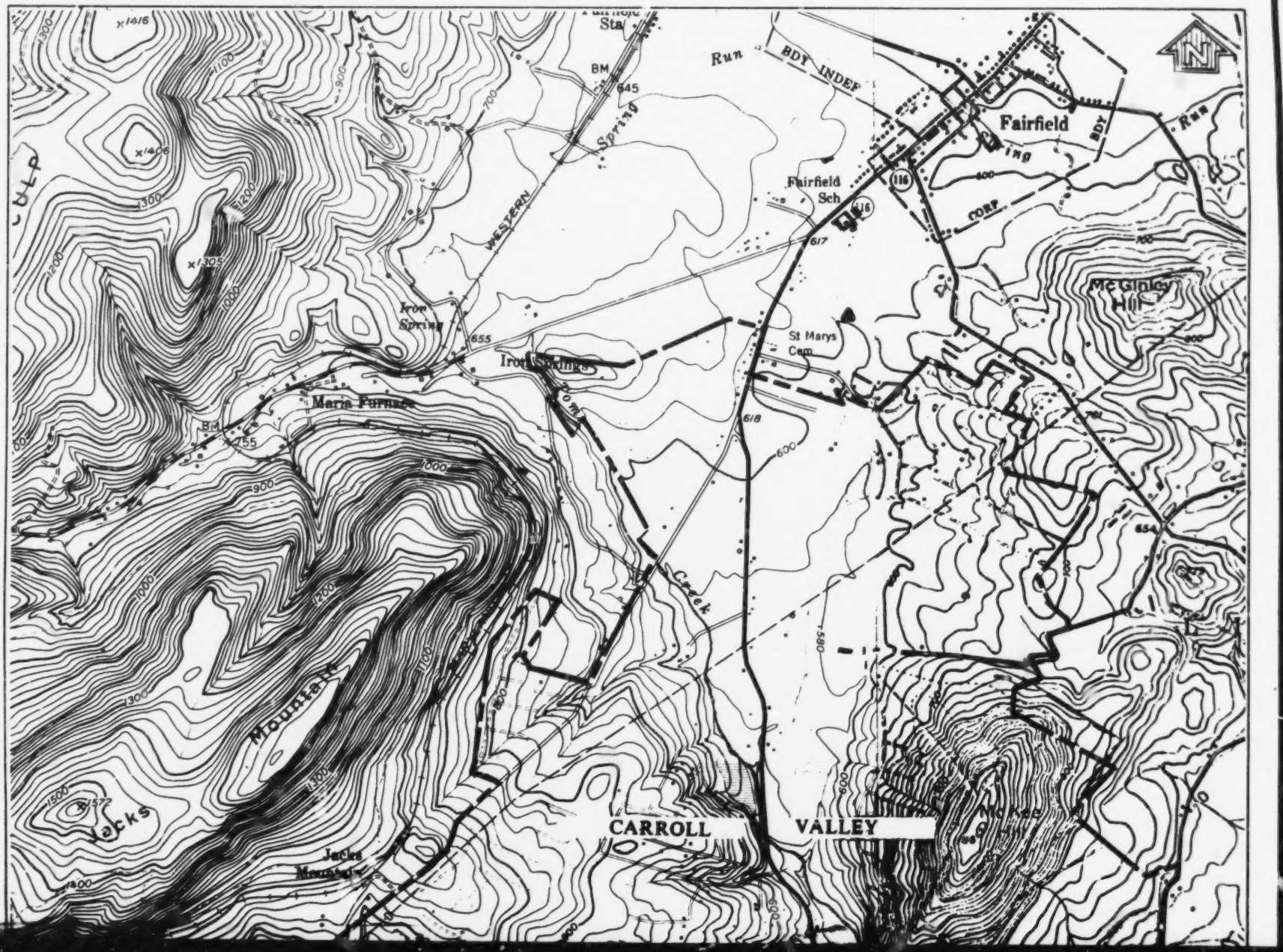
1.3 Coordination

On November 28, 1984, an initial Consultation and Coordination Officer's (CCO) meeting was held with representatives of FEMA, the borough, and the USGS (the study contractor) to determine the streams to be studied by detailed methods. On August 26, 1987, a final CCO meeting was held with representatives of FEMA, the borough, and the study contractor to review the results of the study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Borough of Carroll Valley, Adams County, Pennsylvania. The area of study is shown on the Vicinity Map (Figure 1).


Run
BDY INDEF
Fairfield
Fairfield Sch
Western
Spring
Iron Spring
Maria Furnace
St Marys Cem
McGinley Hill
Creek
Mountain
Jacks
CARROLL
VALLEY
McKee
BM
645
755
655
617
618
116
N

2

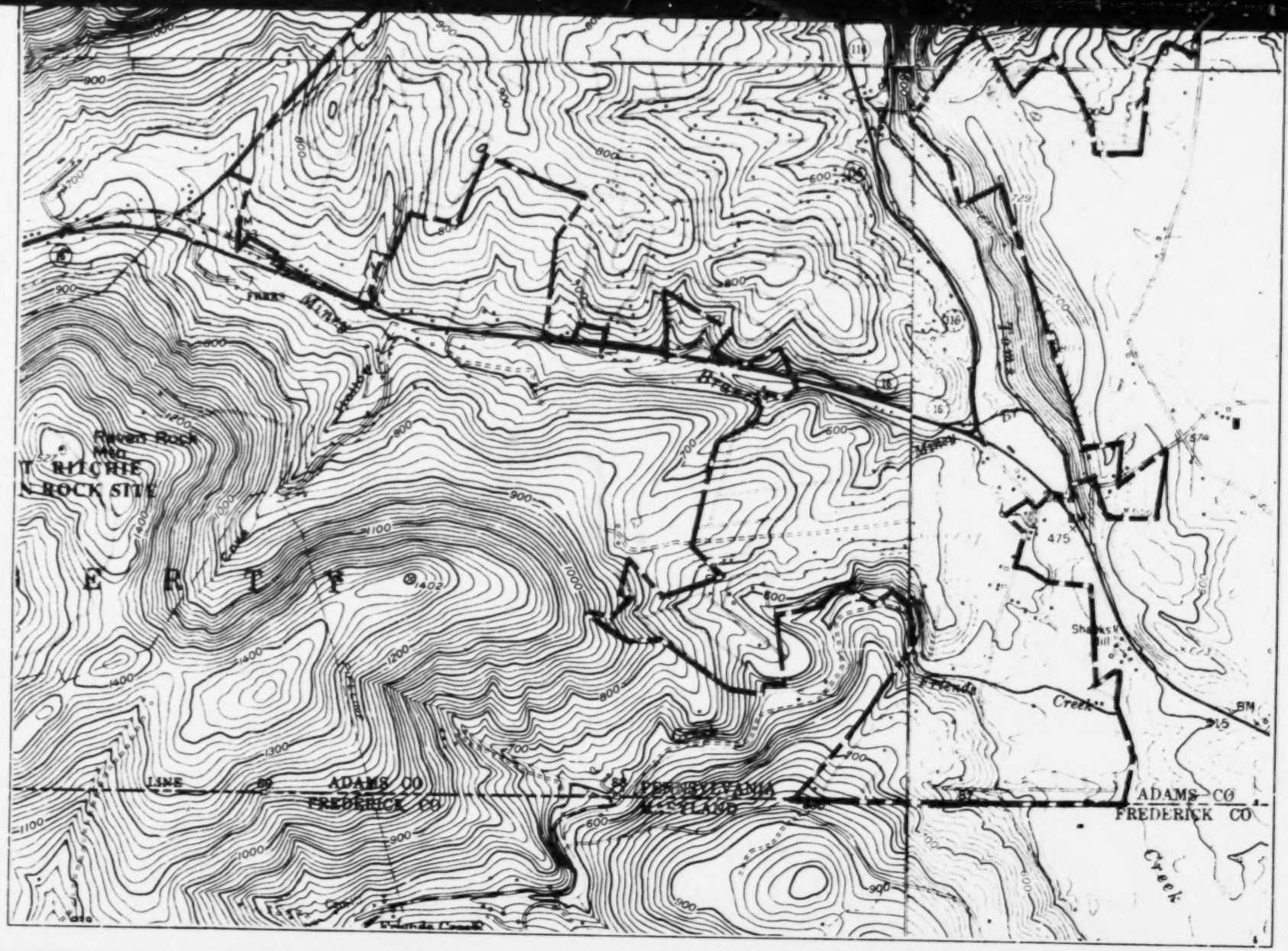


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF CARROLL VALLEY, PA

(ADAMS CO.)

APPROXIMATE SCALE

2000 0 2000 4000 6000 FEET

VICINITY MAP

2A

Toms Creek was studied by detailed methods from the downstream corporate limits to a point approximately 4.5 miles upstream. Friends Creek was studied by detailed methods for its entire length within the community. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through January 1992.

Miney Branch and unnamed tributary to Toms Creek were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the Borough of Carroll Valley.

2.2 Community Description

The Borough of Carroll Valley is located in the southern part of Adams County in southern Pennsylvania, approximately 50 miles southwest of Harrisburg. It is bordered by the Township of Hamiltonban to the north; the Township of Liberty to the east and west; and the unincorporated areas of Frederick County, Maryland, to the south.

2.3 Principal Flood Problems

Major floods cause localized inundation of structures along Toms and Friends Creek.

2.4 Flood Protection Measures

Several impoundments within the borough serve to slightly reduce flooding on Toms Creek and an unnamed tributary to Toms Creek.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. A flood event of a magnitude which is expected to be equaled or exceeded once on the average during any 100-year period (recurrence interval) has been selected as having special significance for floodplain management and for flood insurance rates. This event, commonly termed the 100-year flood, has a 1 percent chance of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to

approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

The flood-frequency discharge values for Toms and Friends Creeks were determined utilizing regional regression equations developed in USGS Water-Resources Investigations 82-21 (Reference 1).

A summary of the drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGE (cfs) 100-YEAR
TOMS CREEK		
At Pennsylvania/Maryland State line	70.0	11,560
Above confluence of Friends Creek	55.4	9,640
Above confluence of Miney Branch	46.6	8,400
At State Route 116 bridge	45.3	8,250
Approximately 0.5 miles above State Route 116 bridge	43.0	7,920
FRIENDS CREEK		
At confluence with Toms Creek	13.7	3,370

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections were field surveyed and located at close intervals above and below bridges and culverts in order to compute the significant backwater effects of these structures. All bridges, dams, and culverts in the community were field surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1) and the Flood Insurance Rate Map (Exhibit 2) where applicable.

Water-surface elevations of the selected recurrence intervals for Toms Creek from the downstream corporate limits to a point approximately 1.73 miles upstream and from points approximately 2.94 miles to 4.50 miles above the downstream corporate limits were computed by modeling channel and bridge hydraulics with the USGS WSPRO step-backwater computer program (References 2 and 3).

For Toms Creek from points approximately 9,120 to 15,500 feet upstream from the downstream corporate limits and for Friends Creek from its mouth to a point approximately 5,010 feet upstream, elevations for the 100-year recurrence interval flood were determined from normal depths of flooding estimated from the regional relationship between drainage area and flood depth (Reference 4). This relationship was developed by means of regional regression analyses of basin areas and 100-year within-channel depths observed at stream gages. Depths were adjusted to account for increased depth due to backwater from hydraulic structures, such as bridges and culverts (References 2, 3, and 5).

Channel roughness factors (Manning's "n") used in the hydraulic computations were assigned on the basis of engineering judgment and field inspection of the floodplain areas. The channel "n" values ranged from 0.034 to 0.038, and the overbank "n" values ranged from 0.043 to 0.150.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100-year floodplain boundaries to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as

the base flood for floodplain management purposes. For the streams studied in detail, the 100-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with a contour interval of 20 feet (Reference 6).

For the streams studied by approximate methods, the boundary of the 100-year flood has been delineated using the Flood Hazard Boundary Map for the Borough of Carroll Valley (Reference 7).

The 100-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE). Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

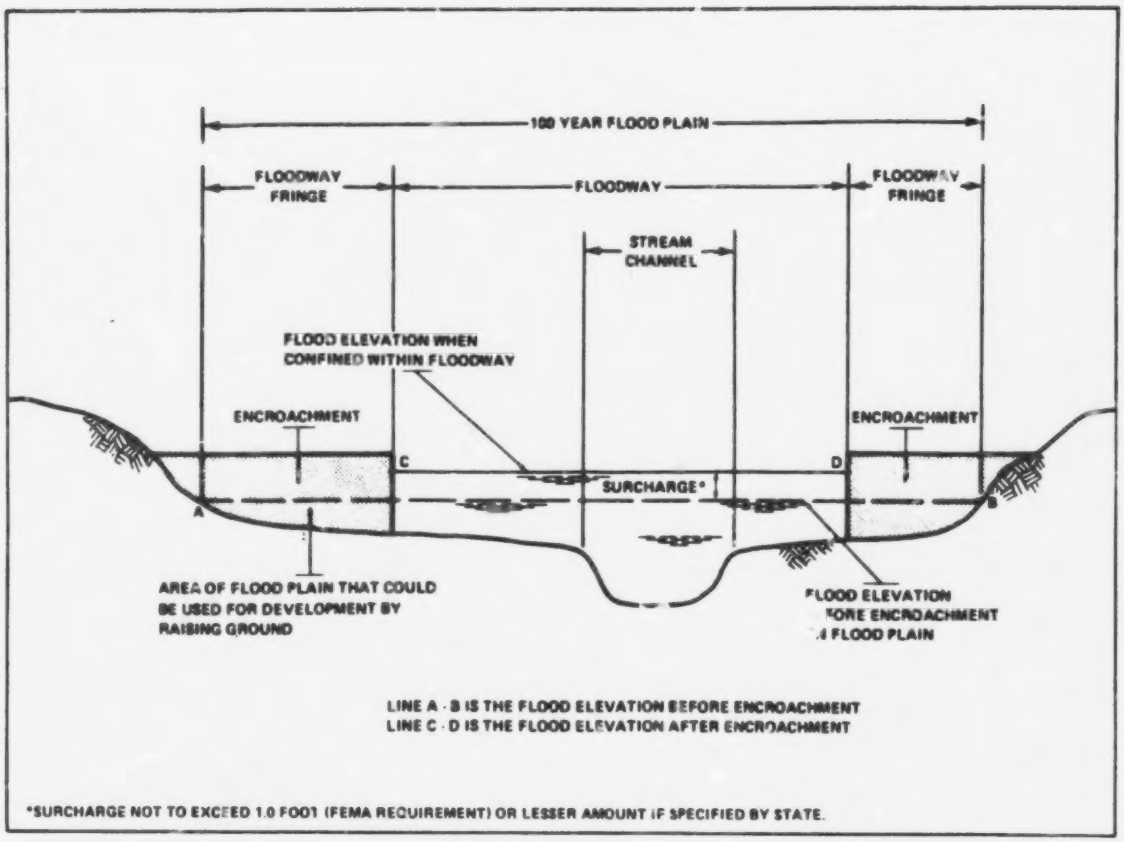
Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

No floodways were calculated as part of this study.

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. The zones are as follows:


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC Figure 2

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

BEST COPY AVAILABLE

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain,and to areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100-year floodplain. The locations of selected cross sections used in the hydraulic analyses are shown where applicable.

7.0 OTHER STUDIES

Flood Insurance Studies for the Townships of Hamiltonban and Liberty are currently being prepared (References 8 and 9). The results of those studies will be in exact agreement with the results of this study.

Due to its more detailed nature, this study supersedes the Flood Hazard Boundary Map for the Borough of Carroll Valley (Reference 7).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA, the Natural and Technological Hazards Division, Liberty Square Building (Second Floor), 105 South Seventh Street, Philadelphia, Pennsylvania 19106.

9.0 BIBLIOGRAPHY AND REFERENCES

1. U. S. Department of the Interior, Geological Survey, Water-Resources Investigations 82-21, Evaluation of the Streamflow-Data Program in Pennsylvania by H. N. Flippo, Jr., Harrisburg, Pennsylvania, 1982.

2. U. S. Federal Highway Administration, Report FHWA/RD-86/108, Bridge Waterways Analysis Model/Research Report (WSPRO) by J. O. Shearman, W. H. Kirby, V. R. Schneider, and H. N. Flippo, Jr., Washington, D. C., 1986.

3. National Technical Information Service, Bridge Waterways Analysis Model/User's Instructions by J. O. Shearman, W. H. Kirby, and V. R. Schneider, Springfield, Virginia, 1985.

4. U. S. Department of the Interior, Geological Survey, Water-Resources Investigations 86-4195, Technique for Estimating Depths of 100-year Floods in Pennsylvania by H. N. Flippo, Jr., Harrisburg, Pennsylvania, 1986.

5. U. S. Department of the Interior, Geological Survey, Techniques of Water-Resources Investigations, Measurement of Peak Discharge at Culverts by Indirect Methods by G. L. Bodhaine, Washington, D. C., 1968.

6. U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 20 Feet: Iron Springs, Pennsylvania, 1953, Photorevised 1973; Blue Ridge Summit, Maryland-Pennsylvania, 1953, Photorevised 1971; Emmitsburg, Maryland-Pennsylvania, 1953, Photorevised 1971.

7. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Borough of Carroll Valley, Adams County, Pennsylvania, March 4, 1977.

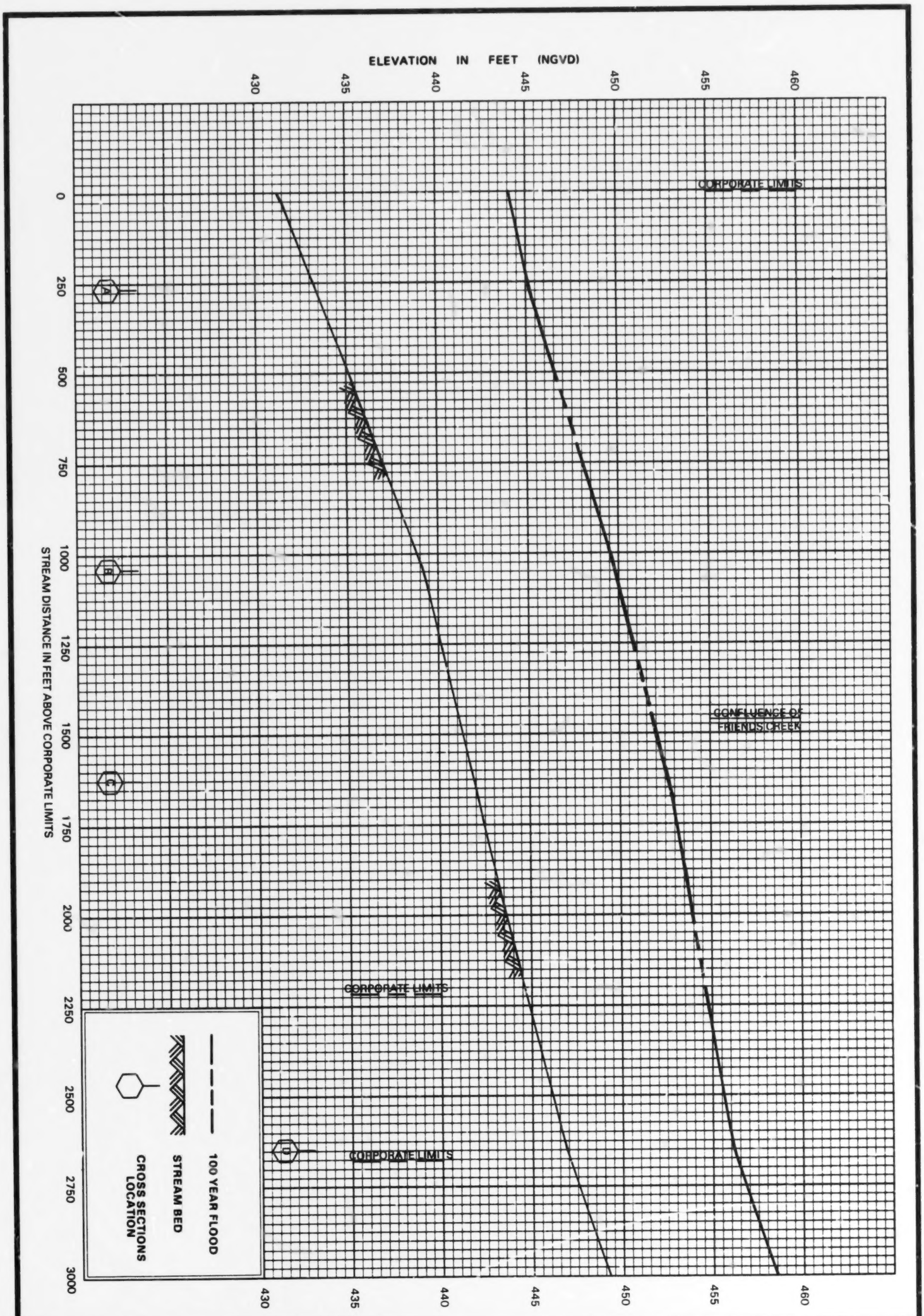
8. Federal Emergency Management Agency, Flood Insurance Study, Township of Hamiltonban, Adams County, Pennsylvania (Unpublished).

9. Federal Emergency Management Agency, Flood Insurance Study, Township of Liberty, Adams County, Pennsylvania (Unpublished).

EXHIBIT 3 - ELEVATION REFERENCE MARKS

Reference Mark	Elevation (Feet NGVD)	Description of Location
RM 1*	659.44	Chiseled square on north end of upstream concrete guard rail on Voo Road bridge over Toms Creek at Iron Springs.
RM 2	547.58	Chiseled square on top of southeast corner of State Route 116 bridge over Toms Creek, 1.65 miles north of junction of State Routes 116 and 16.
RM 3	478.80	PDH disk set in top of northeast wing wall of State Route 16 bridge over Toms Creek.
RM 4	471.47	Chiseled square on top of north upstream wing wall of Ranch Trail bridge over Friends Creek, approximately 0.4 miles upstream from mouth.

*Located outside corporate limits - not shown on maps



FEDERAL EMERGENCY MANAGEMENT AGENCY

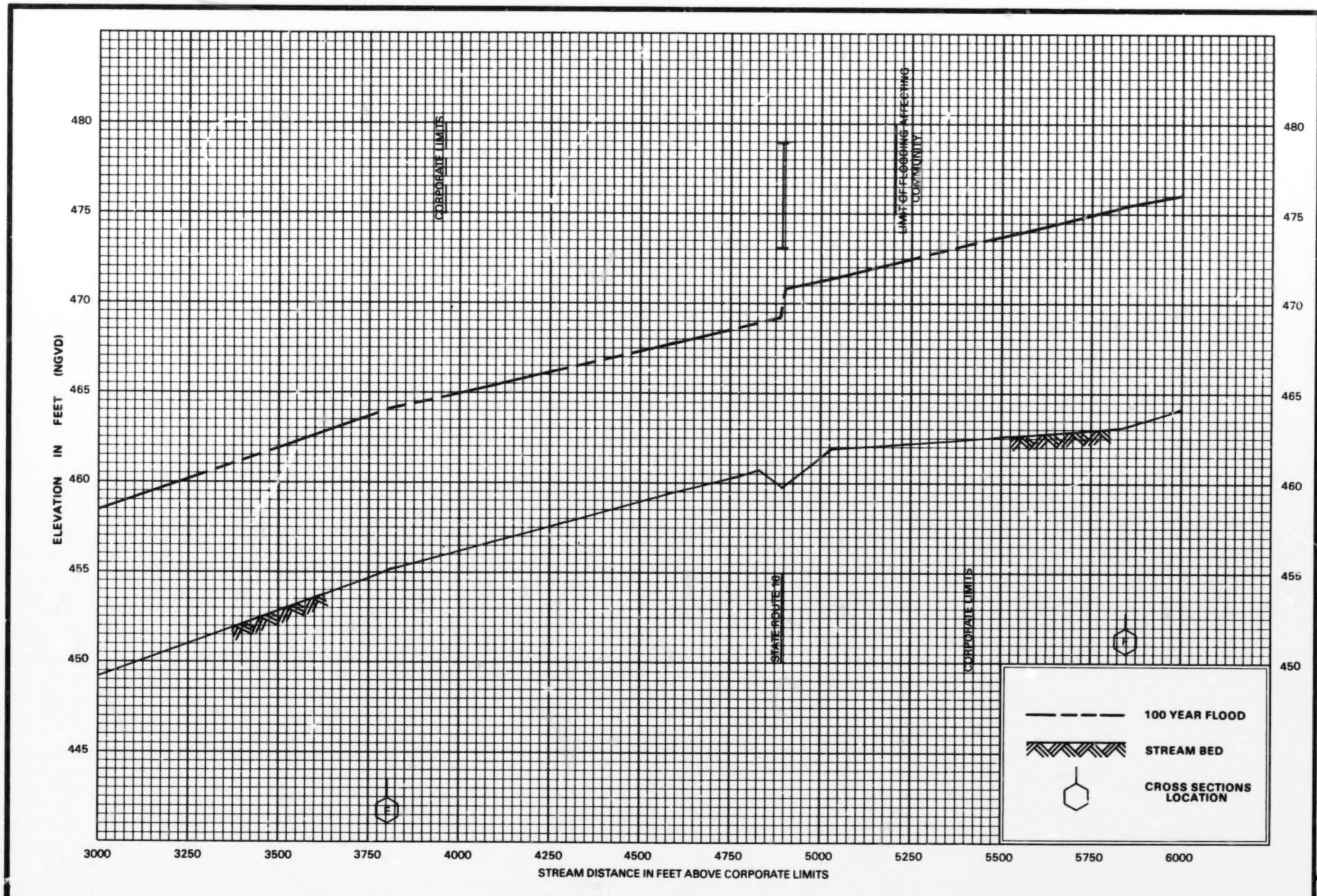
BOROUGH OF CARROLL VALLEY, PA

(ADAMS CO.)

01P

FLOOD PROFILES

TOMS CREEK



FLOOD PROFILES

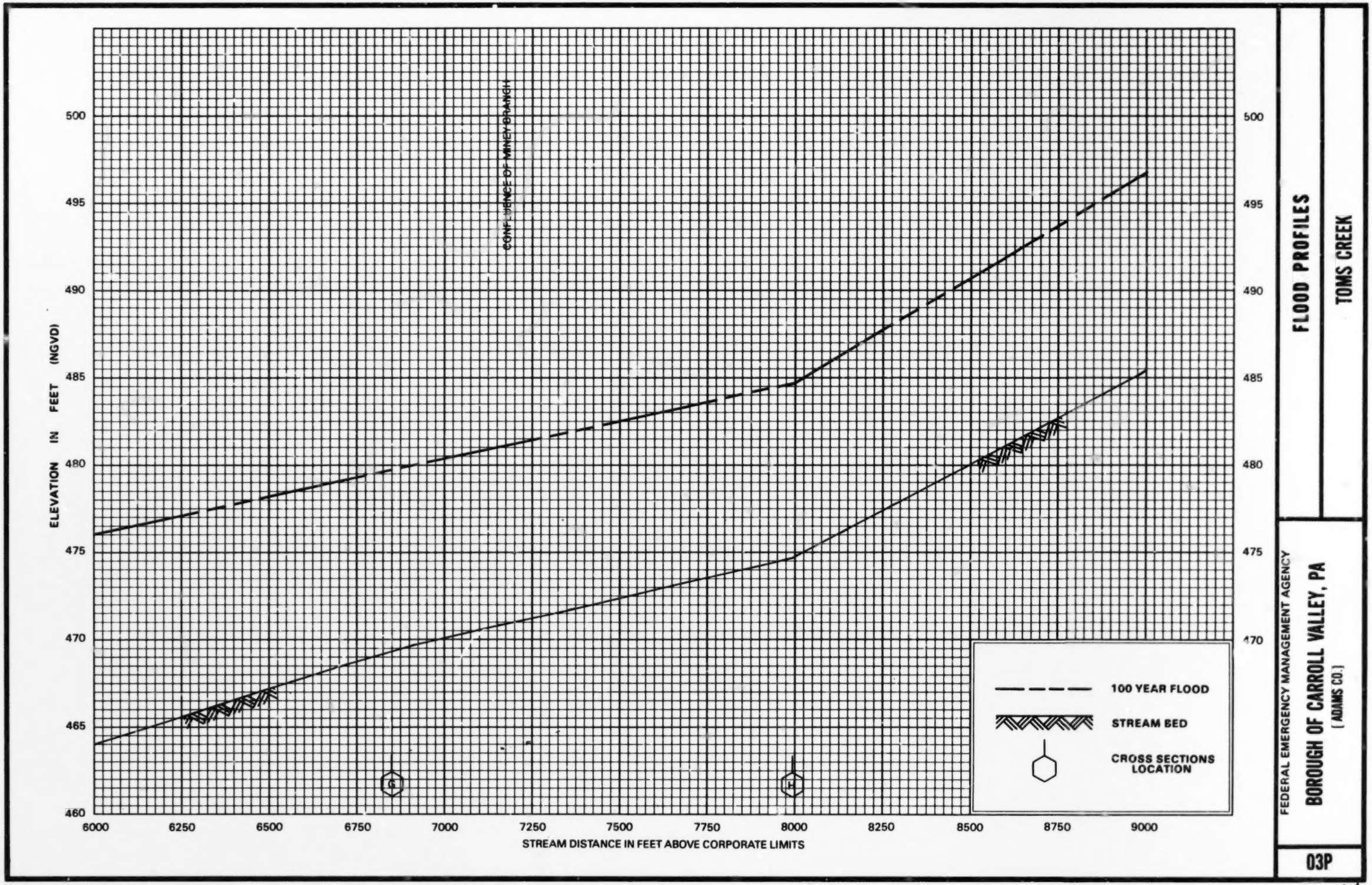
TOMS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF CARROLL VALLEY, PA

(ADAMS CO.)

02P



FLOOD PROFILES

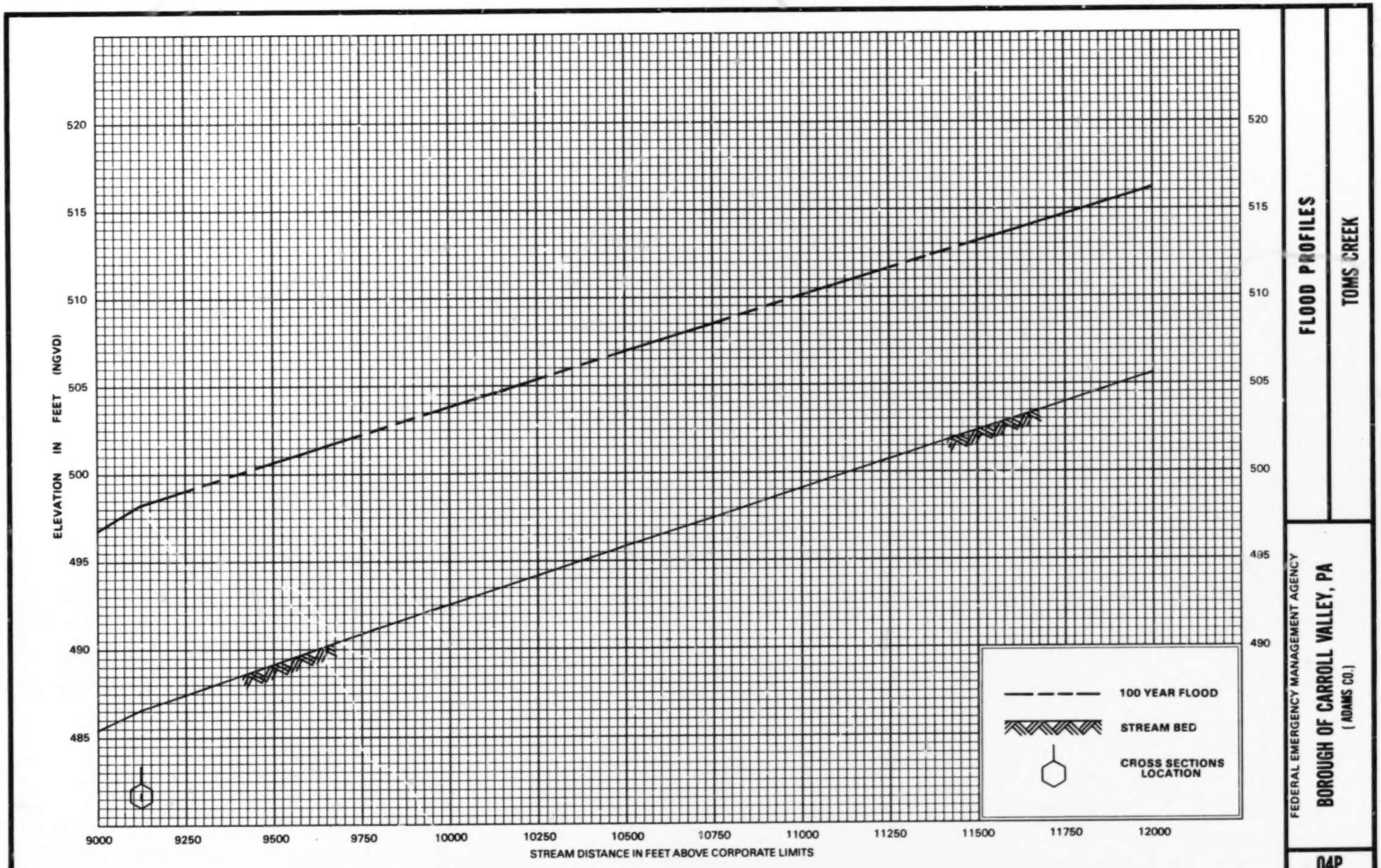
TOMS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF CARROLL VALLEY, PA

[ADAMS CO.]

03P



FLOOD PROFILES

TOMS CREEK

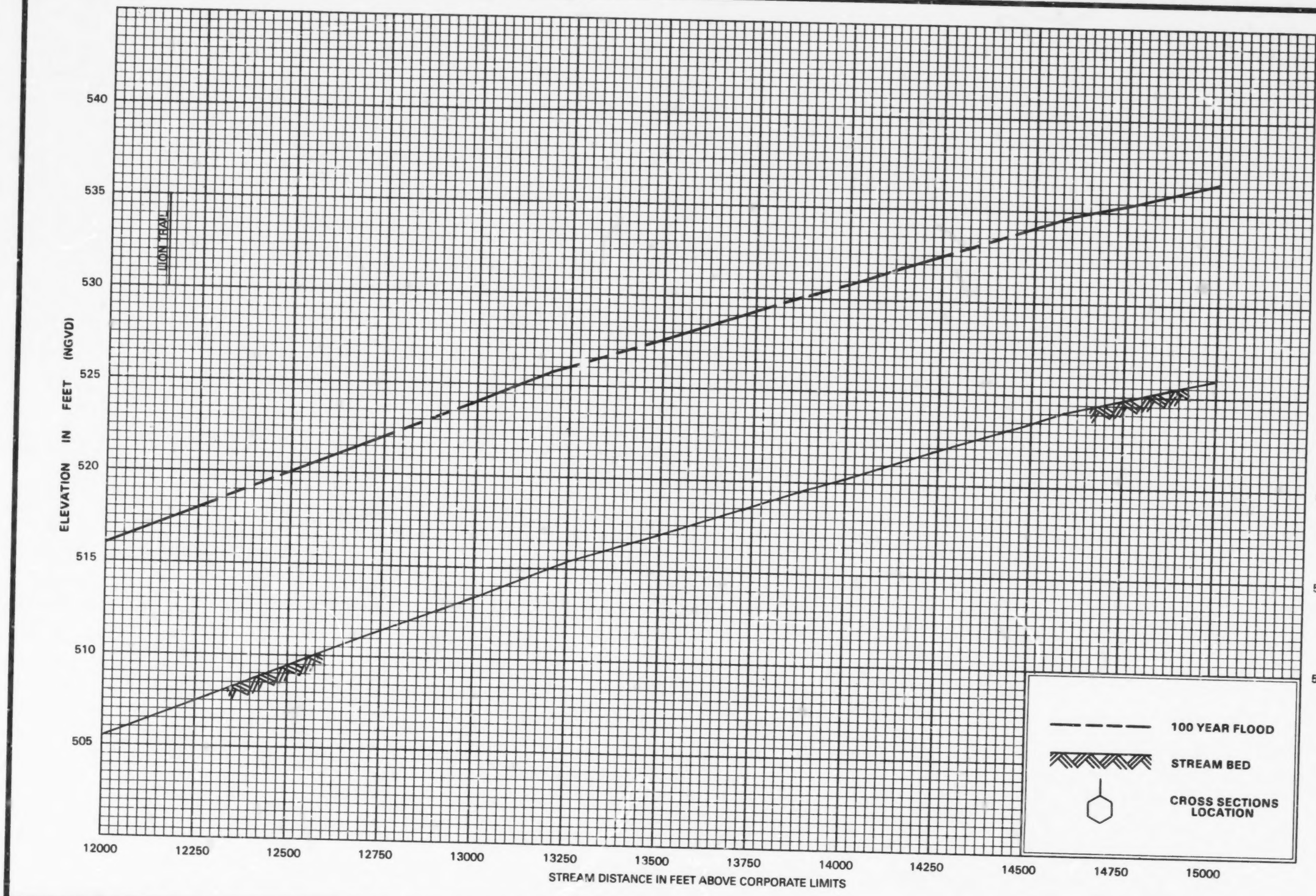
FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF CARROLL VALLEY, PA

(ADAMS CO.)

04P

BLANK PAGE



FLOOD PROFILES

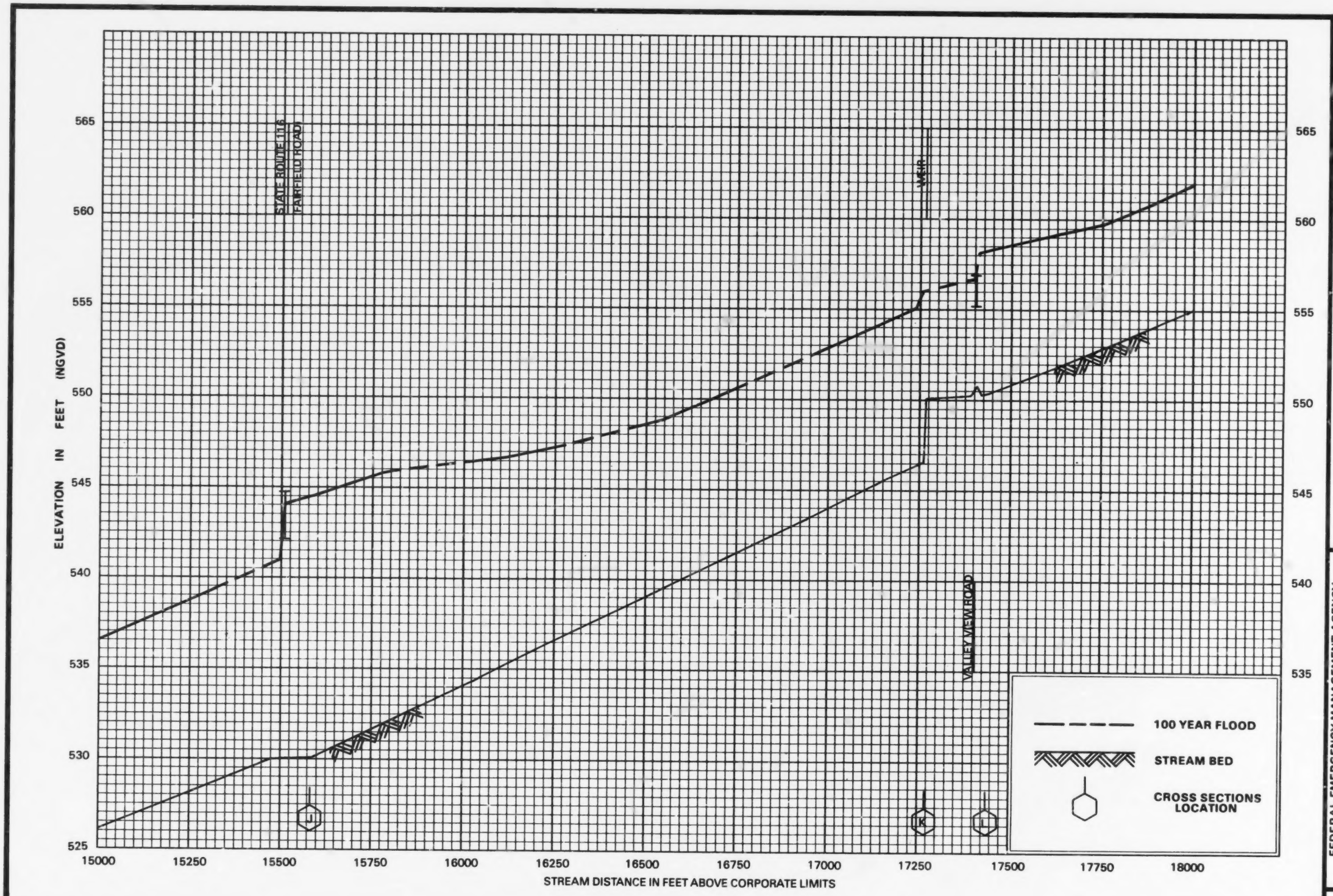
TOMS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF CARROLL VALLEY, PA

(ADAMS CO.)

05P



FLOOD PROFILES

TOMS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF CARROLL VALLEY, PA

(ADAMS CO.)

06P

FLOOD PROFILES

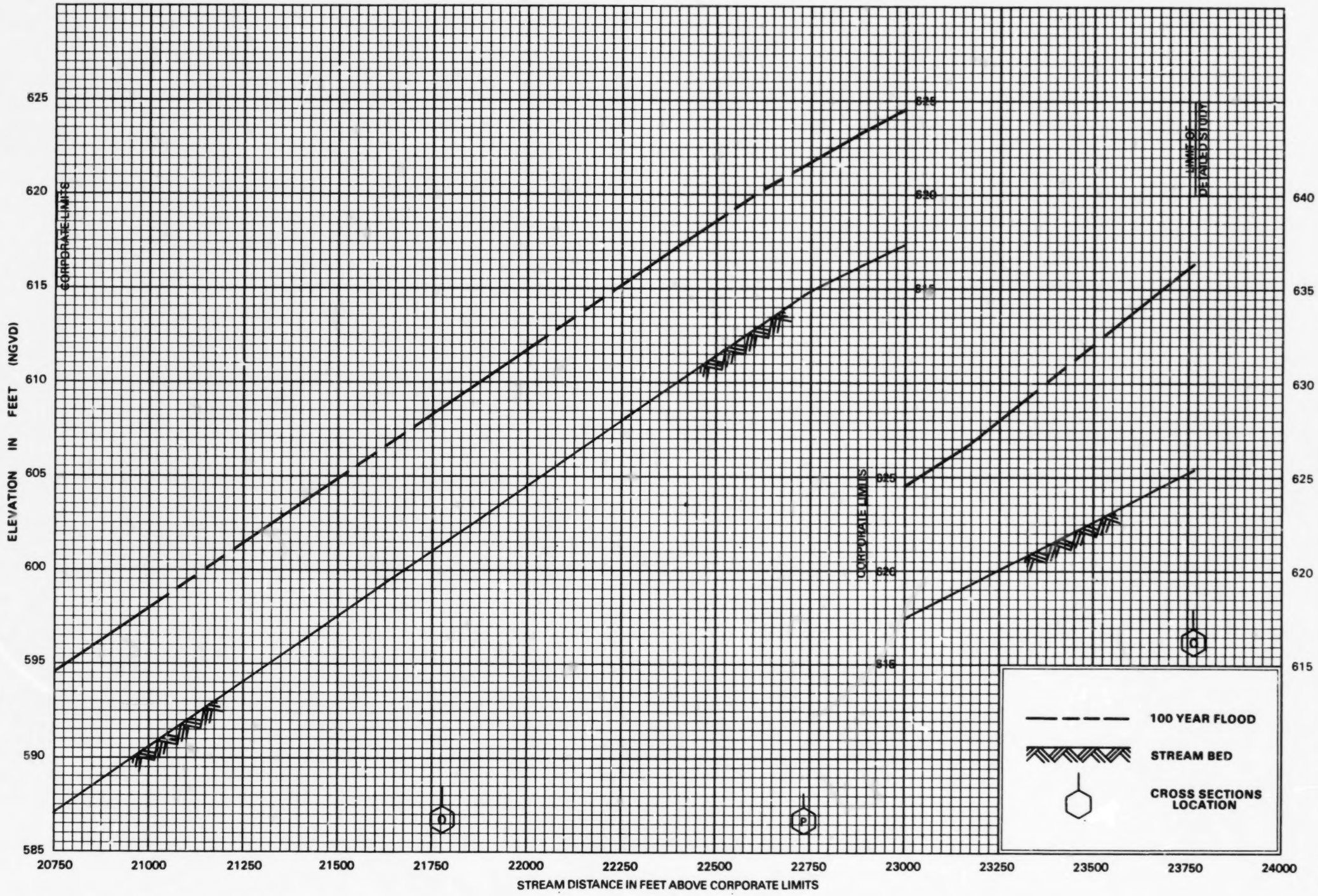
TOMS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF CARROLL VALLEY, PA

(ADAMS CO.)

07P



FLOOD PROFILES

TOMS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF CARROLL VALLEY, PA

(ADAMS CO.)

08P

BACKWATER FROM TOMS CREEK

CONFLUENCE WITH TOMS CREEK

BRANCH TRAIL

ELEVATION IN FEET (NGVD)

475
470
465
460
455
450
445
440

0 250 500 750 1000 1250 1500 1750 2000 2250 2500 2750 3000

STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH TOMS CREEK

100 YEAR FLOOD

STREAM BED

CROSS SECTIONS LOCATION

FLOOD PROFILES

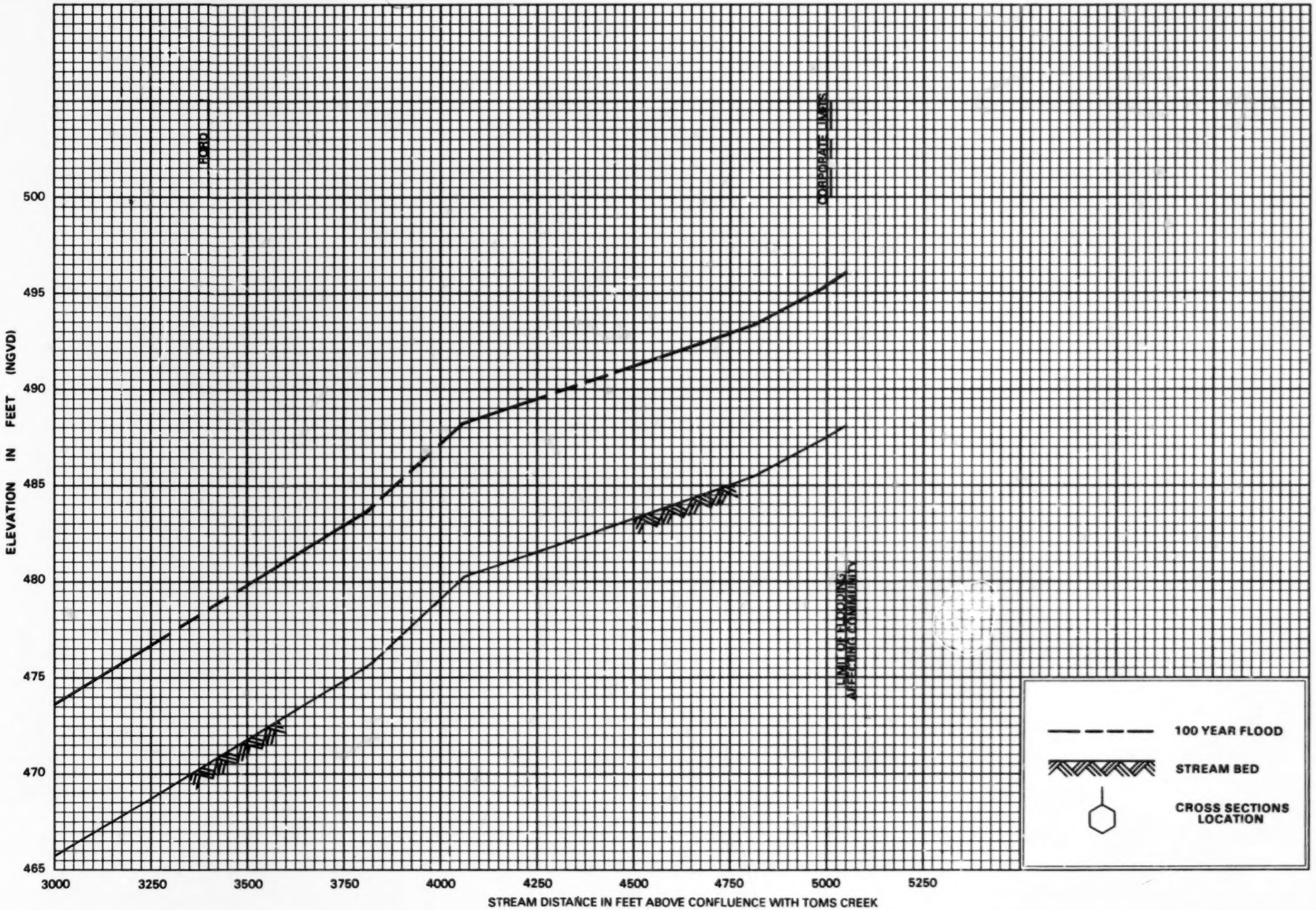
FRIENDS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF CARROLL VALLEY, PA

(ADAMS CO.)

09P



FLOOD PROFILES

FRIENDS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

BOROUGH OF CARROLL VALLEY, PA

(ADAMS CO.)

10P